**D2. Justification of non-salary funding requested from the ARC**

**Travel**

Collaboration is a central part of the development, production and impact of research in mathematics. In particular the majority of the ideas in Section C1 were developed as a result of interactions with overseas colleagues. The technical expertise of colleagues accelerates the writing of quality publications and the progress toward genuinely deep results. It is through joint publications and networks that the impact of the project and the ARC’s investment is maximised.

The project is designed for a high level of interaction between the CI Zanin and other international collaborators in the US and Europe. UNSW is providing additional travel contributions in recognition of the project’s potential. The UNSW contribution will be utilised for conference attendance primarily.

ARC travel funding is requested to enable CI to collaborate with Prof. Nigel Higson and Prof. Marius Junge in the US and engage with North American networks in geometry.

The opportunity for face-to-face collaboration over several weeks is essential for advanced mathematical research. The exchange of ideas and the intense interaction over hand-written notes and boards is still indispensable to mathematics research, and it is not yet replicable by Zoom, emails, or other methods of remote collaboration. Indeed, any serious collaboration requires many hours of intense discussion each day, for weeks, or sometimes even months. The ability to clearly and effectively communicate in front of a board is a powerful catalyst for the completion of substantial collaborations in a timely manner. Additional outcomes of travel will be enhanced training and experience for the PDRA and PGRs, extension of UNSW and Australian impact, and investment in greater international collaboration.

All travel costs are estimated from previous experience and web travel sites such as Google Flights and Booking.com. However, the uncertainty resulting from the ongoing COVID-19 pandemic may lead these numbers to change.

Year 1: (Total 18,900 AUD)

*Reciprocal visit to the US* (Research visit to Penn. State and Nigel Higson) 30 days with PGR student. (2 people)

Airfare US (Penn. State)-Sydney Return: AU$2500 x 2 (AU$5000)

Accommodation, Meals and Incidentals: 30 days @ AU$100 + AU$80 (AU$3000 + AU$2400)

*Reciprocal visit to Germany* (Research visit to Elmar Schrohe) 30 days (1 person)

Airfare Germany (Frankfurt)-Sydney Return: AU$2500

Accommodation: 30 days @ AU$100 (AU$3000)

Meals and Incidentals / Per Diem: 30 days @ AU$100 (AU$3000)

Year 2: (Total 17,400 AUD)

*Reciprocal visit to the US* (Research visit to Penn. State and Nigel Higson) 30 days with PGR student. (2 people)

Airfare US (Penn. State)-Sydney Return: AU$2500 x 2 (AU$5000)

Accommodation, Meals and Incidentals: 30 days @ AU$100 + AU$80 (AU$3000 + AU$2400)

*Reciprocal visit by Nigel Higson* (30 days research visit to UNSW Sydney)

Airfare US (Penn. State)-Sydney Return: AU$2500

Per Diem: 30 days @ AU$150 (AU$4500)

Year 3: (Total 20,400 AUD)

*Reciprocal visit to Germany* (Research visit to Elmar Schrohe) 30 days (1 person)

Airfare Germany (Frankfurt)-Sydney Return: AU$2500

Accommodation: 30 days @ AU$100 (AU$3000)

Meals and Incidentals / Per Diem: 30 days @ AU$100 (AU$3000)

*Reciprocal visit by Elmar Schrohe* (30 days research visit to UNSW Sydney)

Airfare Germany (Frankfurt)-Sydney Return: AU$2500

Per Diem: 30 days @ AU$150 (AU$4500)

Year 4: (Total 17,400 AUD)

*Reciprocal visit to the US* (Research visit to Marius Junge at UIUC) 30 days with PGR student. (2 people)

Airfare US (UIUC)-Sydney Return: AU$2500 x 2 (AU$5000)

Accommodation, Meals and Incidentals: 30 days @ AU$100 + AU$80 (AU$3000 + AU$2400)

*Reciprocal visit by Marius Junge* (30 days research visit to UNSW Sydney)

Airfare US (Chicago)-Sydney Return: AU$2500

Per Diem: 30 days @ AU$150 (AU$4500)

Travel costs are calculated using estimates of present-day domestic and international economy airfares, accommodation and a modest per-diem allowance. These figures add up to AU$68,100 over Years 1-4.